Gaia Radial Velocity Spectrometer Performance

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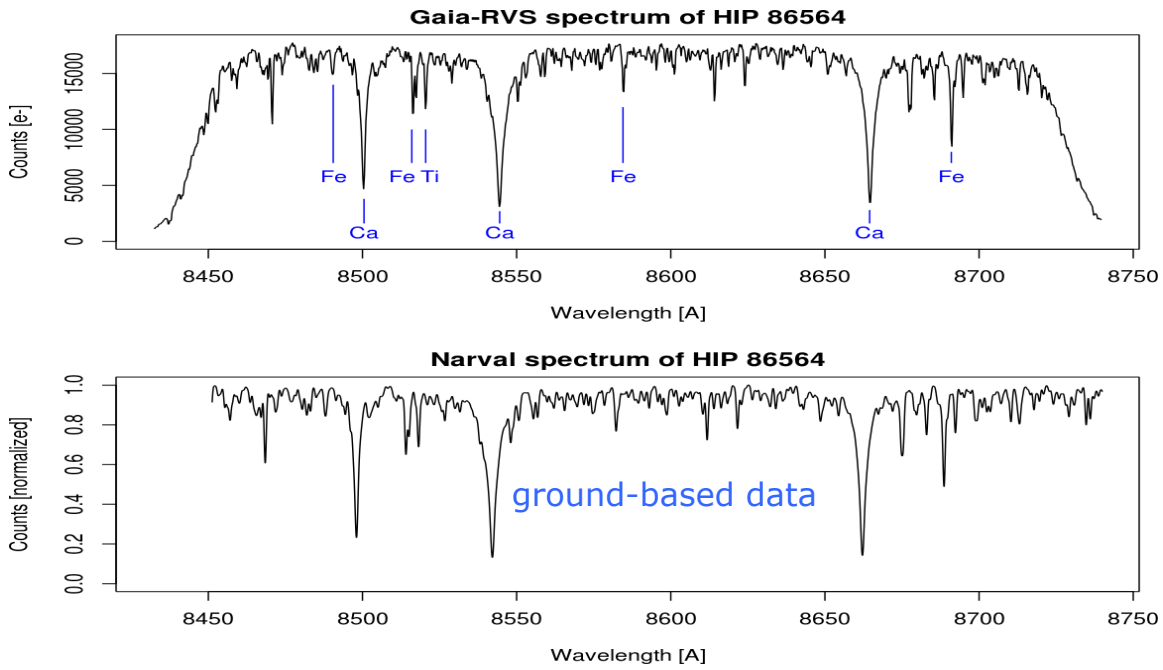
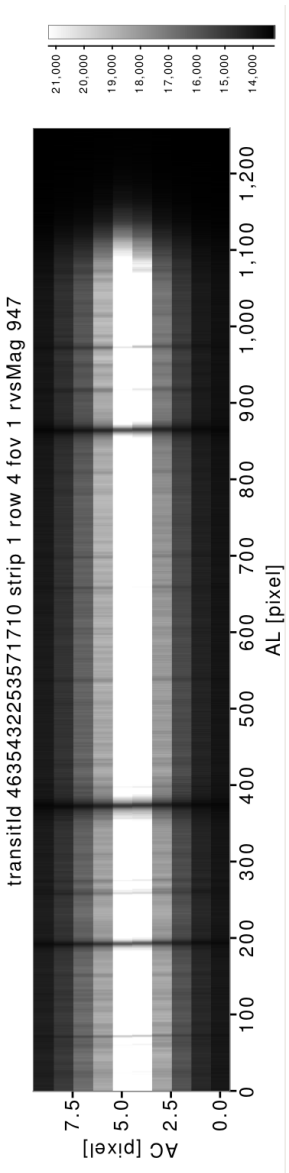
(CU6 Payload Experts)

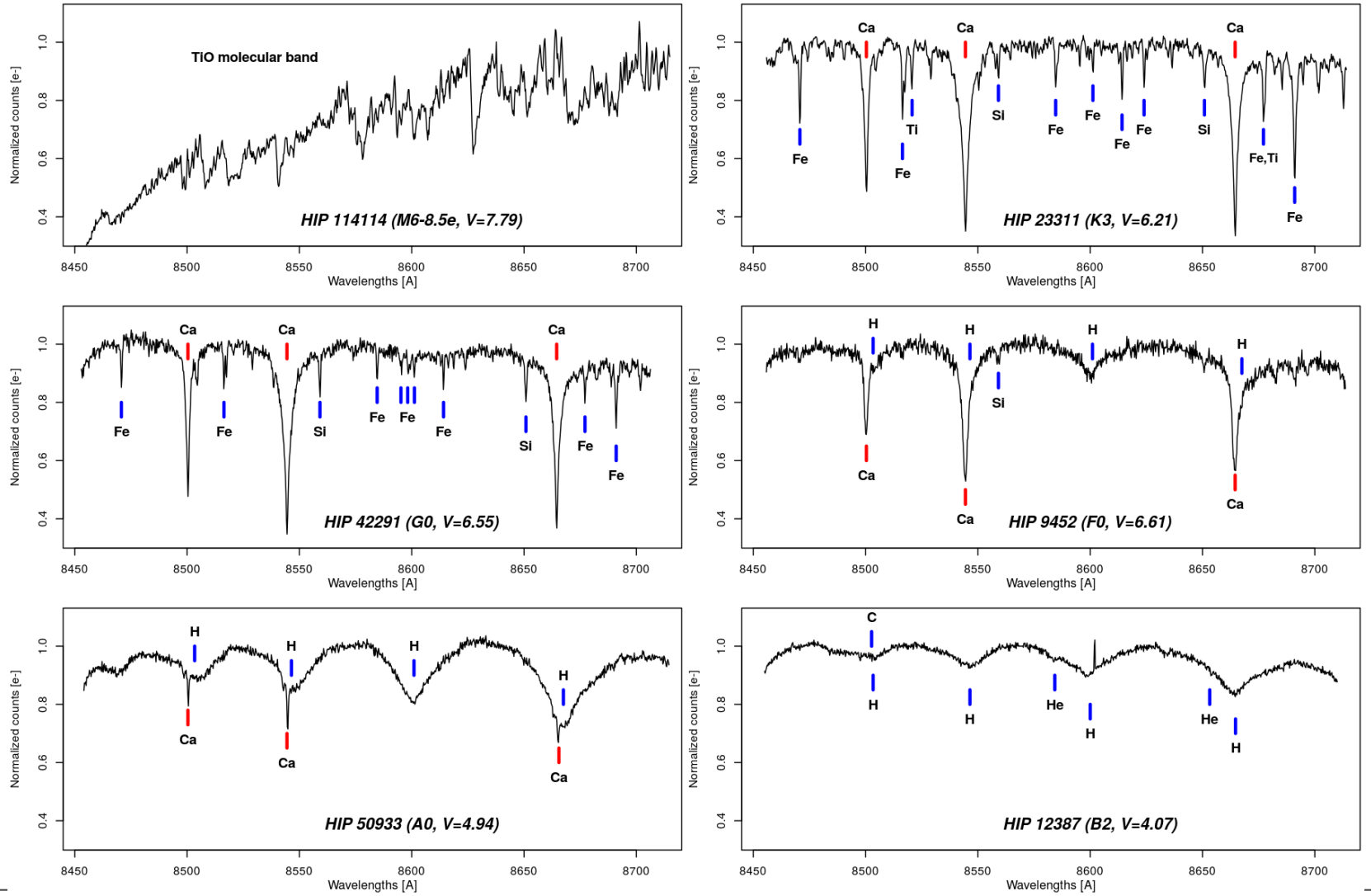
First Public RVS Spectra





- most spectra are not this good, however…

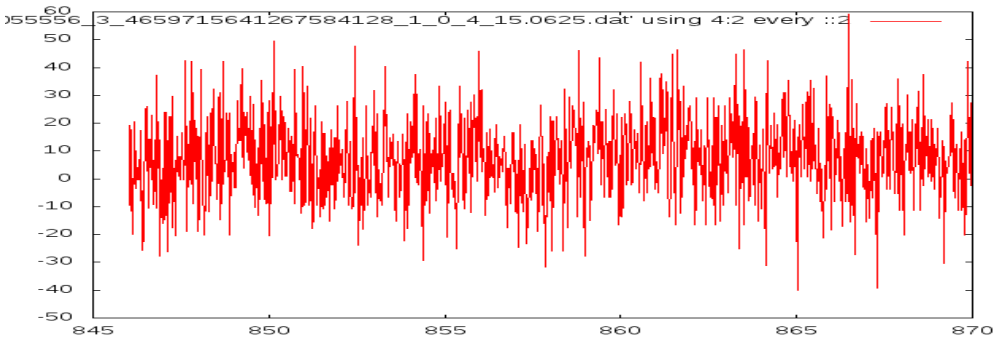
Typical single transit spectra from bright stars

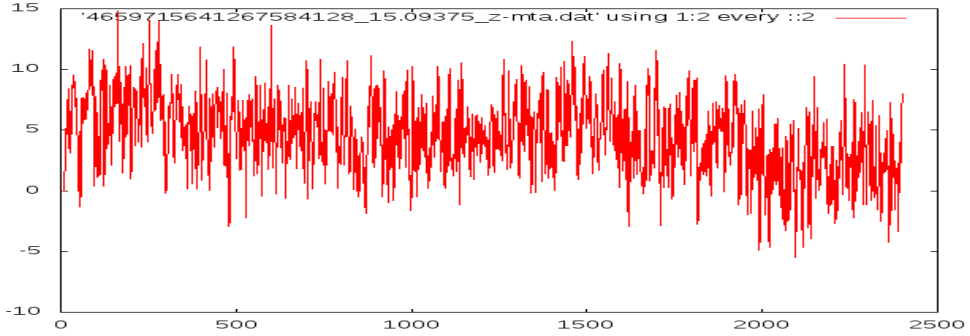


Typical Spectra and CCFs from a V=15 star

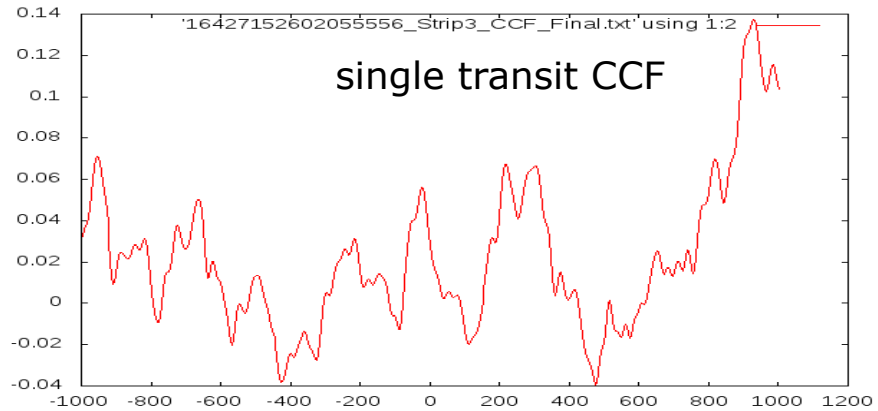
- Spectra and cross-correlation functions are highly noise-dominated at the faint limit.

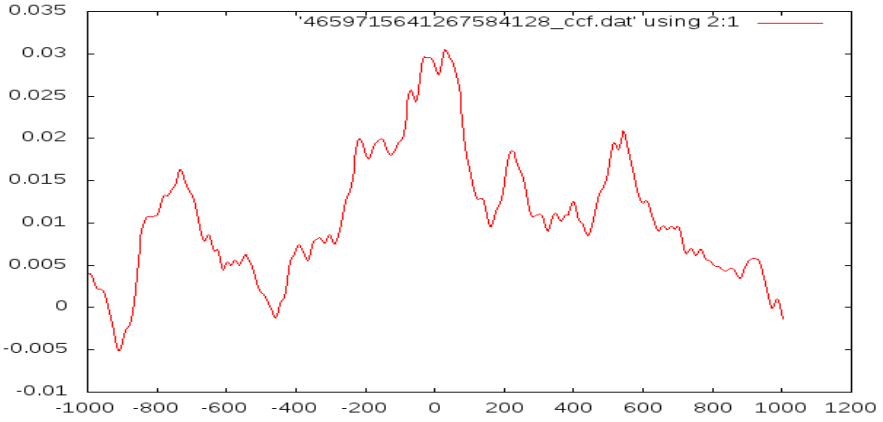
3 CCD exposure (1 transit)





40 transit spectrum

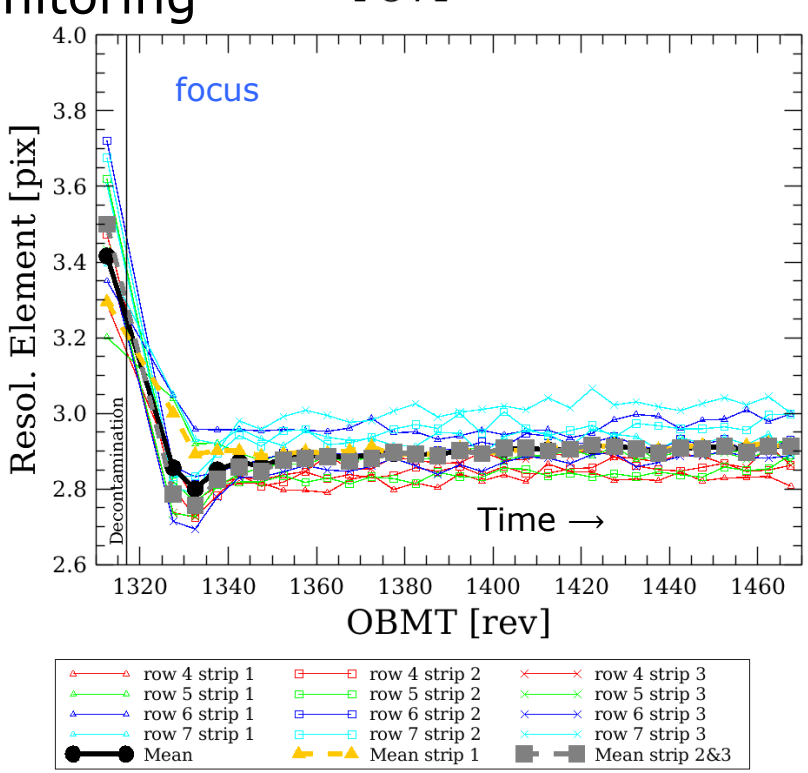


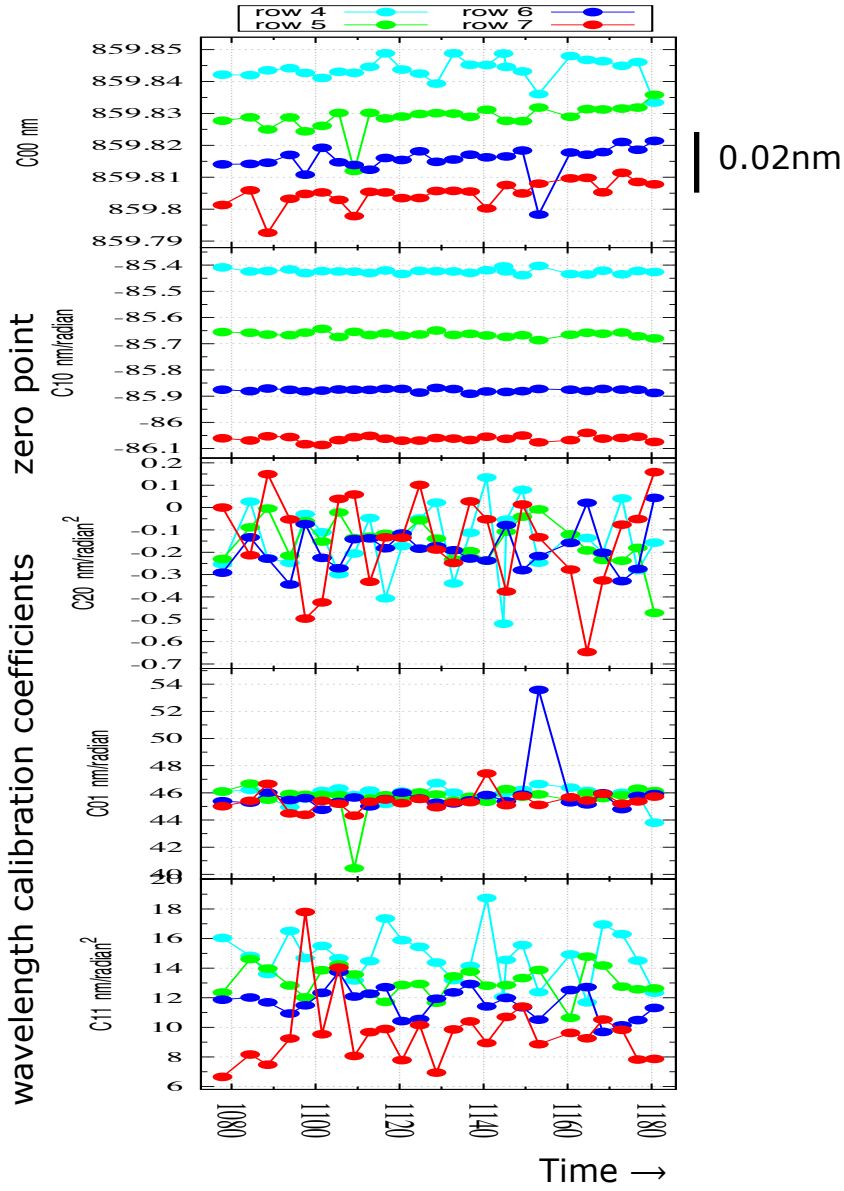


40 transit CCF

Resolution and Stability

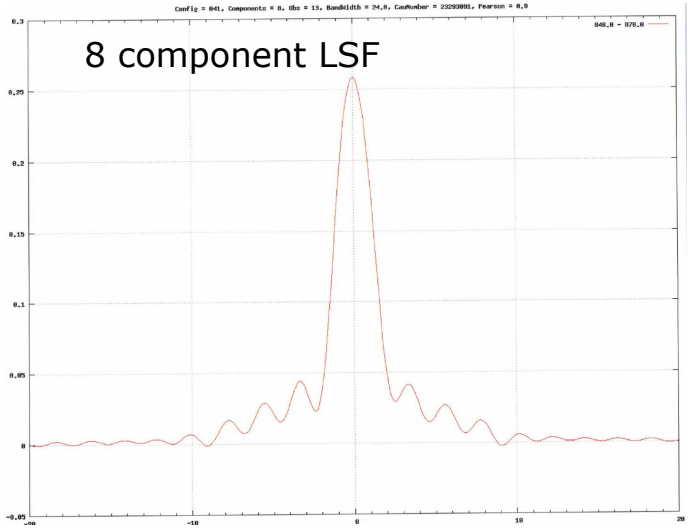
- spectral resolution is within specification at R>10500
- throughput is (slightly) better than nominal after decontamination
- stability is good but needs further monitoring

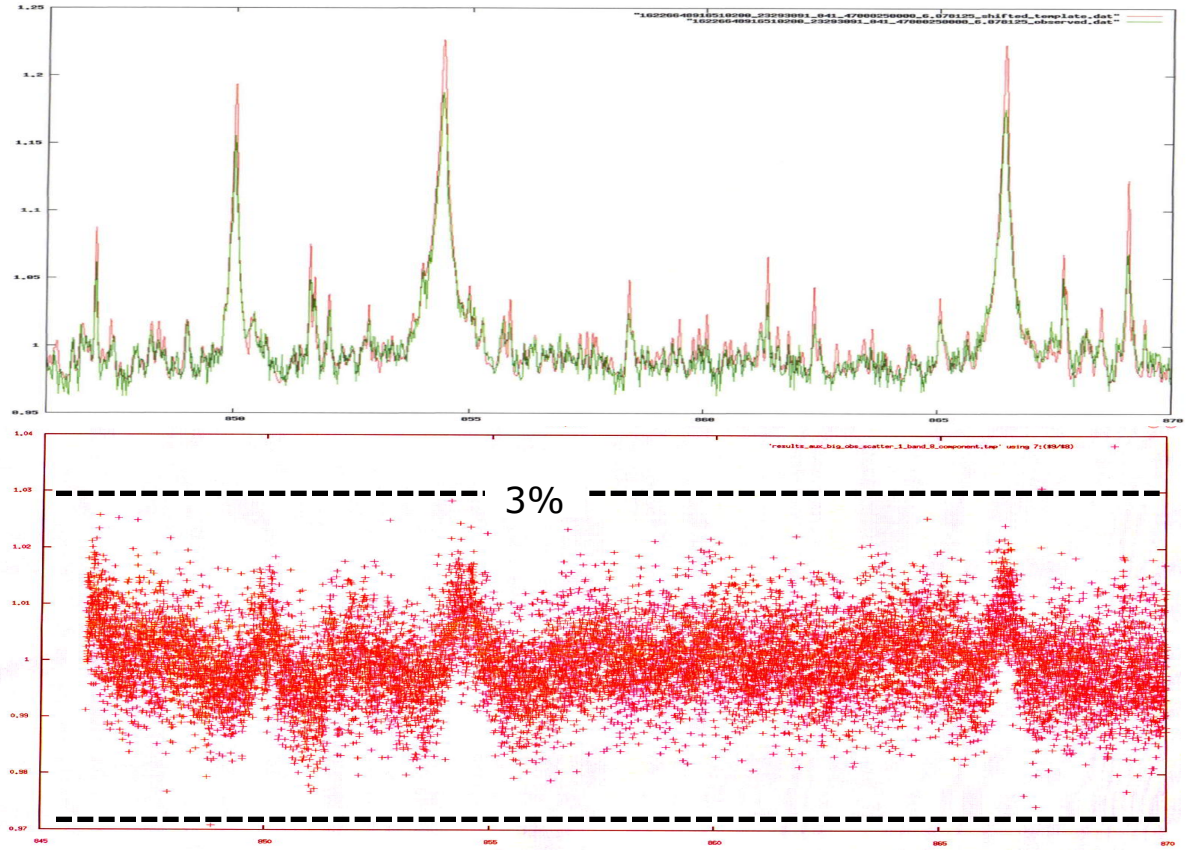




LSF Along Scan Calibration using PCA

- Shortage of standards until EPSL data have made AC LSF difficult to calibrate
- Now achieving < 3% residuals except in core of Ca lines

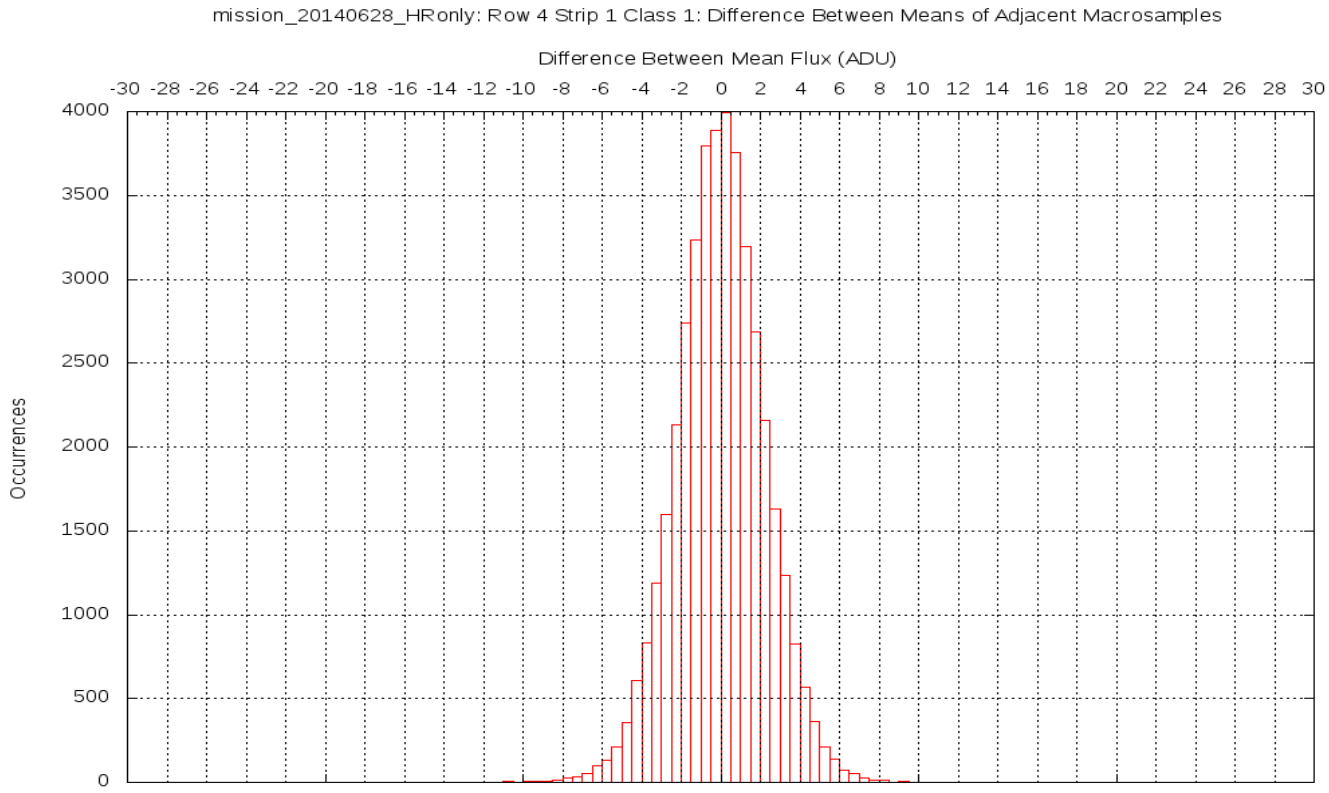




residuals in 13 spectra

Electronic bias stability ("bias non-uniformity")

- The electronic bias level changes depending on the pattern of stars on the detector (sequence of window reads and unwanted pixel flushes)
- Effect can be calibrated using Virtual Objects



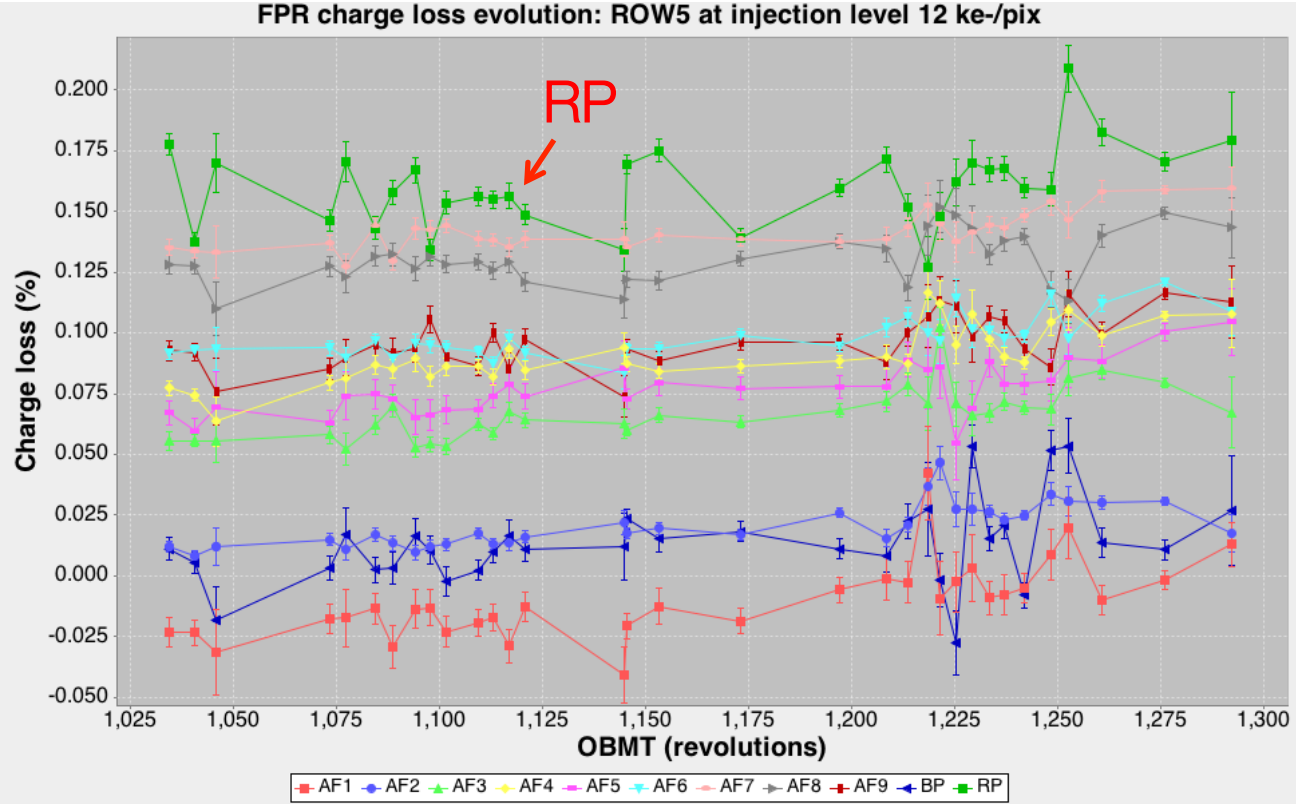
correction is sufficiently effective

σ ~ 1.7 ADU

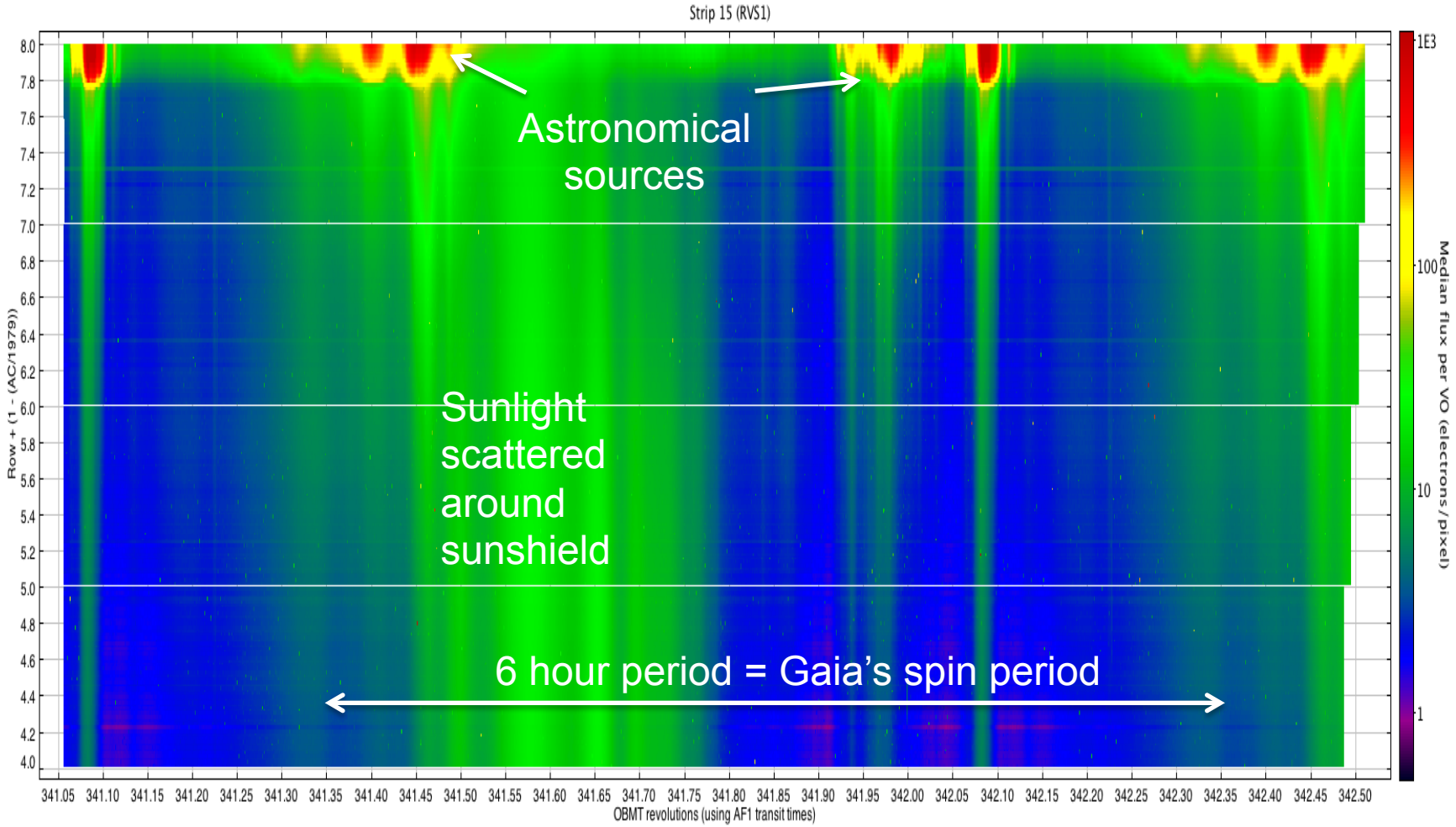
σ ~ 0.9 e^-

Radiation damage

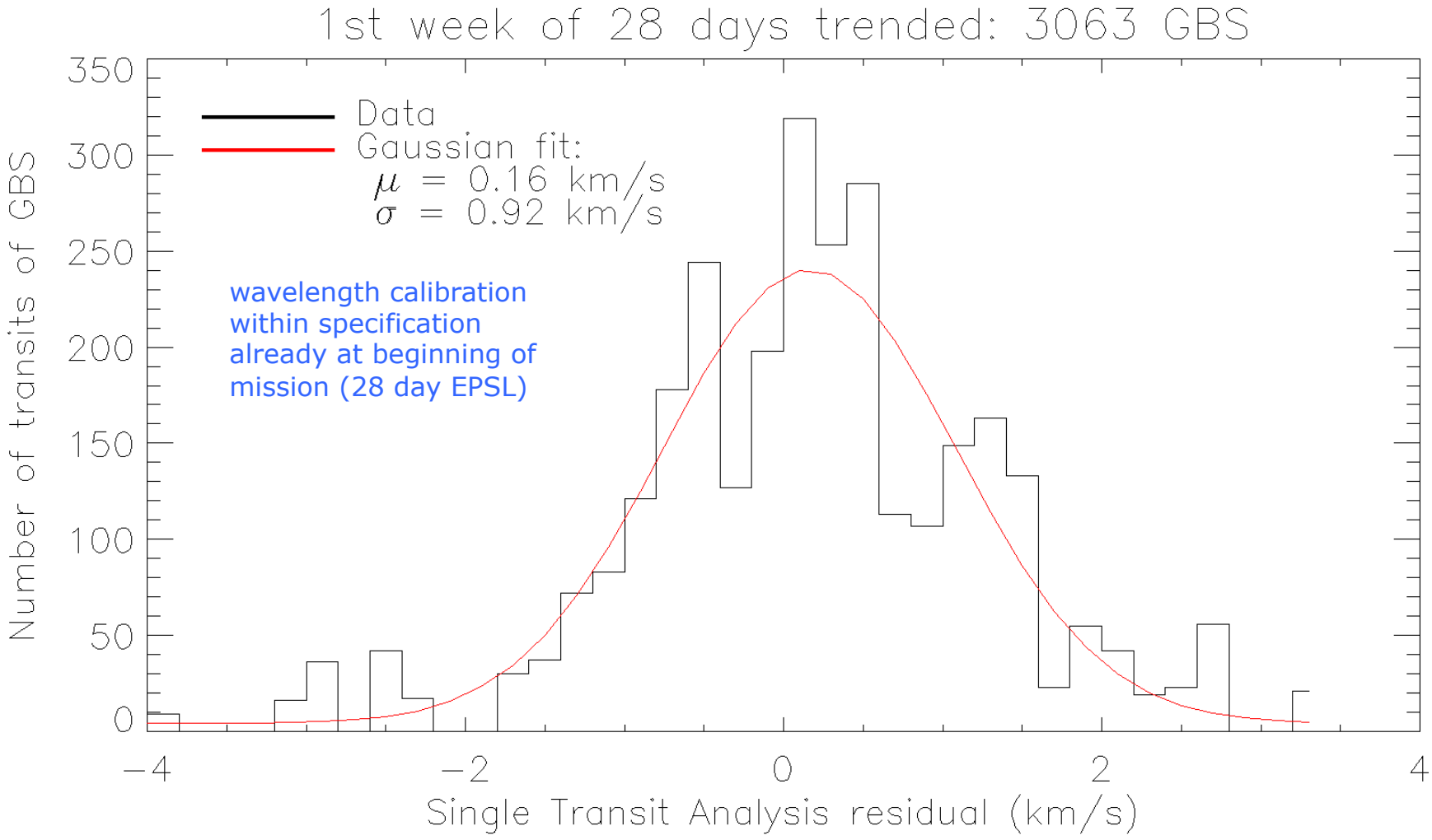
- No radiation damage measurements yet analysed for RVS, but should be similar to RP: small increase in damage seen after 7 months
- Analysis by Cross & Hambly (2014, GAIA-CH-TN-IFA-NJC-006) indicates approx pre-launch expectation of level of damage for RP: TBC for RVS



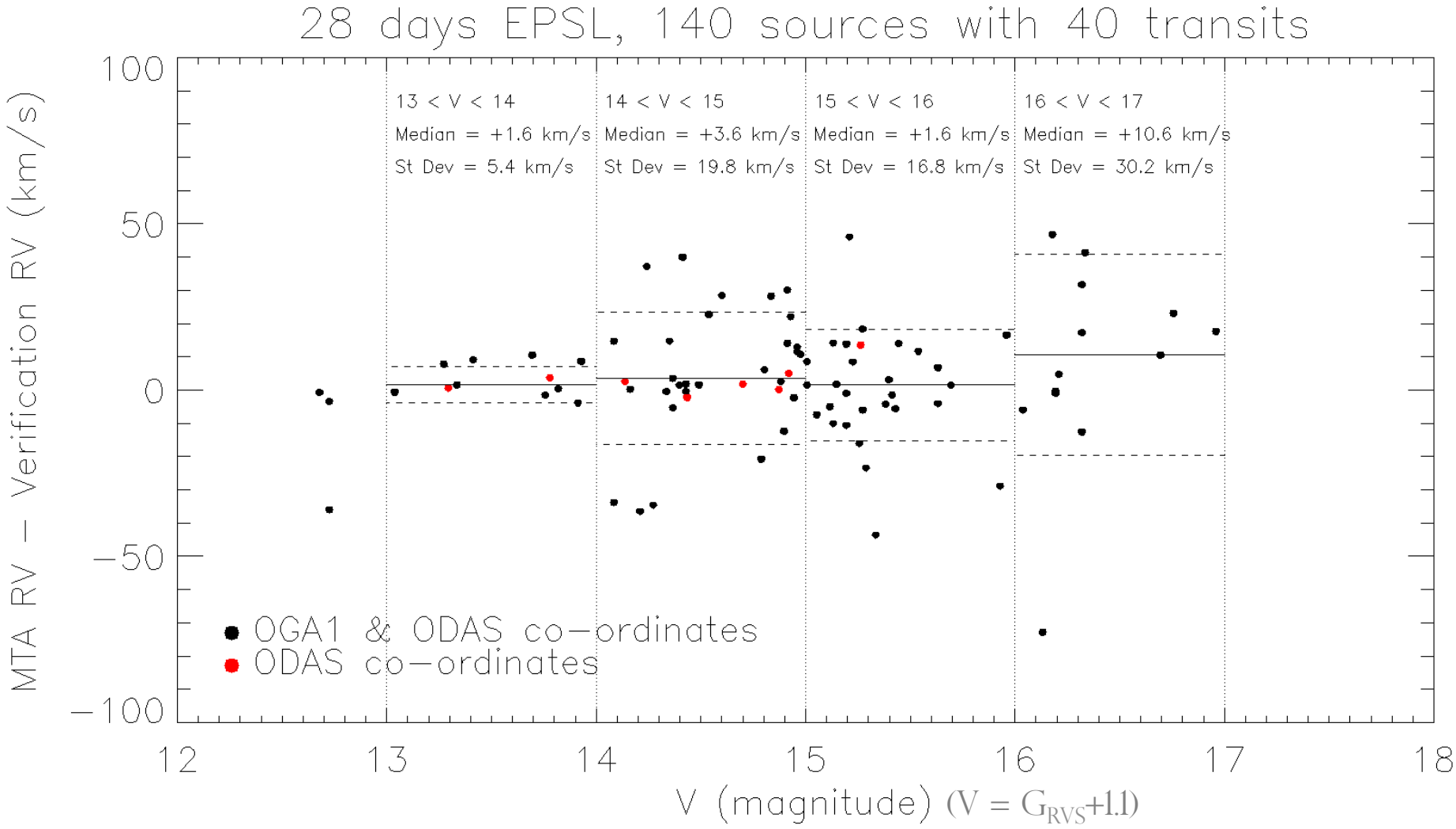
RVS Scattered Light: mean level 30x expected



Wavelength Calibration: standards



Radial Velocity Precision: faint stars

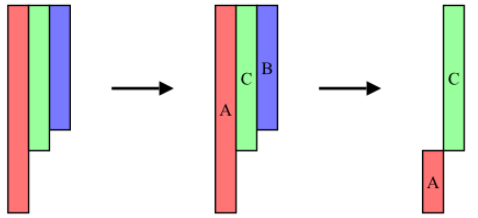


RVS Optimisation

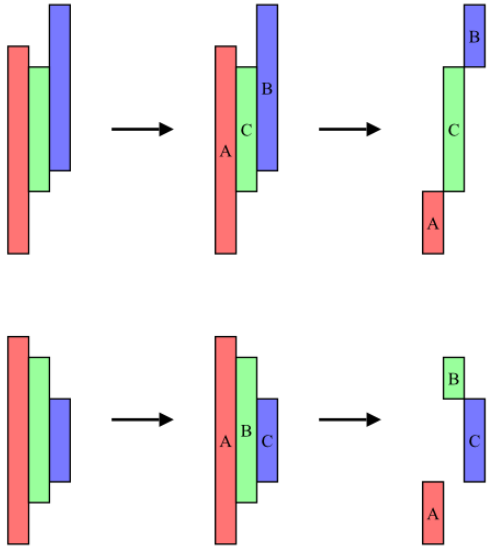
- RVS was designed as a readout noise-limited instrument, but now is background limited
  ⇒ need to minimise background
  ⇒ need to minimise window width as
  f(G_{RVS}, spin phase, FoV)
- No need to use LR Mode (RoN dominated)
  ⇒ HR mode only (R~10500)

- Complex overlapping schemes on VPUs on board
- Complex decoding of overlaps, deblending and bias-NU correction on-ground
- Under implementation by Airbus D&S and DPAC (early 2015)

- Gain is ~0.3 mag = 50% more stars



AC widths per macrosample



Example of triple-overlaps

Summary of Current Performance Status

- RVS is operating well except for the scattered light:
  in specification except for the faint limit (loss ~1.3 mag)

- Throughput is as (slightly better than) expected
- Stability is adequate for RVS wavelength and LSF calibration

- DPAC-CU6 software is working well and to specification for this mission epoch

- Because of the scattered light, there are instrument upgrades to compensate by minimising window width
  ⇒ additional challenges have arisen for CU6 software development

- RVS will produce ~100 spectra per second; ~15 billion spectra (6 yr)
  ⇒ unprecedented scale of resource for Galactic science